

Claims

1. An optical transmission system, comprising:
 - a transmitter unit;
 - a receiver unit;
 - an optical transmission path interconnecting the transmitter and receiver units;
 - a plurality of optical repeaters situated along the transmission path, wherein adjacent ones of the repeaters are interconnected by transmission spans that collectively constituting a majority of the optical transmission path, each of said transmission spans comprising substantially identical lengths of cabled optical fiber having substantially identical prescribed path average dispersions;
 - at least one adjustable dispersion trimming element located in at least one of said optical repeaters and optically coupling one of said transmission spans to an optical amplifier located in said at least one repeater, said adjustable dispersion trimming element having an adjustable path average dispersion selected such that a total path average dispersion of the transmission span to which it is coupled plus the adjustable dispersion trimming element has a desired value.
2. The optical transmission system of claim 1 wherein said at least one adjustable dispersion trimming element includes a plurality of adjustable dispersion trimming elements respectively located in the plurality of optical repeaters and being optically coupled to a respective one of the transmission spans.
3. The optical transmission system of claim 1 wherein each of said optical repeaters includes an optical amplifier, said at least one adjustable dispersion trimming element being located at an input to one of said optical amplifiers.
4. The optical transmission system of claim 1 wherein each of said optical repeaters includes an optical amplifier, said at least one adjustable dispersion trimming element being located at an output to one of said optical amplifiers.

5. The optical transmission system of claim 1 wherein said prescribed path average dispersion of each of the transmission spans is approximately equal to zero.
6. The optical transmission system of claim 3 wherein said optical amplifiers are rare-earth doped optical amplifiers.
7. The optical transmission system of claim 4 wherein said optical amplifiers are rare-earth doped optical amplifiers.
8. The optical transmission system of claim 1 wherein said adjustable dispersion trimming element comprises spooled optical fiber.
9. The optical transmission system of claim 1 wherein said adjustable dispersion trimming element comprises a Bragg grating.
10. The optical transmission system of claim 1 wherein at least one of said transmission spans comprises a cabled optical fiber having a single value of dispersion.
11. The optical transmission system of claim 1 wherein at least one of said transmission spans comprises a plurality of cabled optical fibers each having a different value of dispersion.
12. The optical transmission system of claim 8 wherein at least one of said transmission spans comprises a cabled optical fiber having a single value of dispersion.
13. The optical transmission system of claim 12 wherein said spooled optical fiber has a dispersion value substantially greater than said single dispersion value of the cabled optical fiber.
14. An optical transmission system, comprising:
 - a transmitter unit;
 - a receiver unit;

an optical transmission path interconnecting the transmitter and receiver units, said optical transmission path having a periodic dispersion map with a period comprising a fixed component and an adjustable component;

a plurality of optical repeaters situated along the transmission path, wherein adjacent ones of the repeaters are spaced apart by respective transmission spans, said fixed components of the periodic dispersion map being provided by the respective transmission spans;

at least one adjustable dispersion trimming element located in at least one of said optical repeaters and optically coupling one of said transmission spans to an optical amplifier located in said at least one repeater, said adjustable dispersion trimming element having an adjustable path average dispersion that provides said adjustable component of the periodic dispersion map, said adjustable path average dispersion being selected such that the fixed component of the period of the periodic dispersion map plus the adjustable component of the dispersion map associated therewith has a desired value.

15. The optical transmission system of claim 14 wherein said at least one adjustable dispersion trimming element includes a plurality of adjustable dispersion trimming elements respectively located in the plurality of optical repeaters and being optically coupled to a respective one of the transmission spans.

16. The optical transmission system of claim 14 wherein each of said optical repeaters includes an optical amplifier, said at least one adjustable dispersion trimming element being located at an input to one of said optical amplifiers.

17. The optical transmission system of claim 14 wherein each of said optical repeaters includes an optical amplifier, said at least one adjustable dispersion trimming element being located at an output to one of said optical amplifiers.

18. The optical transmission system of claim 14 wherein said fixed component of the periodic dispersion map is approximately equal to zero.

19. The optical transmission system of claim 14 wherein said optical repeaters include at least one optical amplifier.

20. The optical transmission system of claim 19 wherein said optical amplifier is a rare-earth doped optical amplifier.

21. The optical transmission system of claim 14 wherein said adjustable dispersion trimming element comprises spooled optical fiber.

22. The optical transmission system of claim 14 wherein said adjustable dispersion trimming element comprises a Bragg grating.

23. The optical transmission system of claim 14 wherein at least one of said transmission spans comprises a cabled optical fiber having a single value of dispersion.

24. The optical transmission system of claim 14 wherein at least one of said transmission spans comprises a plurality of cabled optical fibers each having a different value of dispersion.

25. The optical transmission system of claim 21 wherein at least one of said transmission spans comprises a cabled optical fiber having a single value of dispersion.

26. The optical transmission system of claim 25 wherein said spooled optical fiber has a dispersion value substantially greater than said single dispersion value of the cabled optical fiber.

27. A method of establishing a dispersion map for an optical transmission system, having an optical transmission path that includes a plurality of optical amplifiers interconnected by respective transmission spans, said method comprising the steps of:
selecting a desired path average dispersion for each period of the dispersion map, said desired path average dispersion having a first fixed component

arising from a respective one of the transmission spans associated with each period and a second adjustable component associated with each period; and

for a given period, adjusting a path average dispersion to achieve said desired path average dispersion by trimming the second adjustable component associated with the given period.

28. The method of claim 27 wherein the adjusting step is performed by at least one adjustable dispersion trimming element associated with one of the optical amplifiers.

29. The method of claim 28 wherein said at least one adjustable dispersion trimming element comprises a plurality of adjustable dispersion trimming elements respectively associated with the plurality of optical amplifiers and being optically coupled to a respective one of the transmission spans.

30. The method of claim 28 wherein said at least one adjustable dispersion trimming element is located at an input to the optical amplifier.

31. The method of claim 28 wherein said at least one adjustable dispersion trimming element is located at an output to the optical amplifier.

32. The method of claim 27 wherein said first fixed component of the periodic dispersion map is approximately equal to zero.

33. The method of claim 27 wherein said optical amplifier is a rare-earth doped optical amplifier.

34. The method of claim 28 wherein said adjustable dispersion trimming element comprises spooled optical fiber.

35. The method of claim 28 wherein said adjustable dispersion trimming element comprises a Bragg grating.

36. The method of claim 27 wherein at least one of said transmission spans comprises a cabled optical fiber having a single value of dispersion.

37. The method of claim 27 wherein at least one of said transmission spans comprises a plurality of cabled optical fibers each having a different value of dispersion.

38. The method of claim 34 wherein at least one of said transmission spans comprises a cabled optical fiber having a single value of dispersion.

39. The method of claim 38 wherein said spooled optical fiber has a dispersion value substantially greater than said single dispersion value of the cabled optical fiber.

40. A method of assembling an optical transmission system, said method comprising the steps of:

providing a plurality of optical repeaters each having an input and output, each of said repeaters including an optical amplifier and an adjustable dispersion trimming element;

providing a plurality of spans of cabled optical fiber, each of said spans comprising substantially identical lengths of optical fiber having substantially identical prescribed path average dispersions;

optically coupling the input and output of each of the repeaters to an end of one of the spans of cabled optical fiber to form a transmission path having a concatenation of optical repeaters such that each of the spans of cabled optical fiber is associated with one of the adjustable dispersion trimming elements; and

adjusting a path average dispersion of the adjustable dispersion trimming elements to achieve a desired total path average dispersion for the cabled optical fiber span and the adjustable trimming element associated therewith.

41. The method of claim 40 wherein said adjustable dispersion trimming elements are respectively at the inputs to the optical repeaters.

42. The method of claim 40 wherein said adjustable dispersion trimming elements are respectively at the outputs to the optical repeaters.

43. The method of claim 40 wherein said substantially identical prescribed prescribed path average dispersion is approximately equal to zero.

44. The method of claim 40 wherein said optical amplifiers are rare-earth doped optical amplifiers.

45. The method of claim 40 wherein said adjustable dispersion trimming elements comprise spooled optical fibers.

46. The method of claim 40 wherein said adjustable dispersion trimming elements comprise Bragg gratings.

47. The method of claim 40 wherein at least one of said spans of cabled optical fiber comprises a cabled optical fiber having a single value of dispersion.

48. The method of claim 40 wherein at least one of said spans of cabled optical fiber comprises a plurality of cabled optical fibers each having a different value of dispersion.

49. The method of claim 45 wherein at least one of said spans of cabled optical fiber comprises a cabled optical fiber having a single value of dispersion.

50. The method of claim 49 wherein said spooled optical fiber has a dispersion value substantially greater than said single dispersion value of the cabled optical fiber.